REMARKS

In the office action, the examiner finds independent claims 52 and 61 to be rendered obvious by the combination of three references: Behrens, Bernd and Cosentino.

The invention of claims 52 and 61 is a method of increasing the rise time of bubbles emitted by a diffuser in water for the purpose of suppressing noise in a marine seismic survey. The inventive method accomplishes this by applying a chemical additive to the diffuser's surface with a brush (claim 52) or by spraying (claim 61). The chemical additive must have either bubble coalescence retardation properties, or wetting agent properties or both.

Behrens discloses using air bubbles emitted by a diffuser to suppress noise in a seismic survey. No use of chemical additives is disclosed or suggested. Bernd discloses a method of concealing a ship from sonar detection by a submarine, the method being a way of prolonging the life of the bubbles in the ship's wake by introducing into the water in the vicinity of the bubbles a chemical additive that will tend to prevent the bubbles from disappearing by dissolving into the water. Cosentino discloses a method of initially priming a blood oxygenator used in open heart surgery to more efficiently flush out extraneous gas by coating the oxygenator surfaces with a wetting agent that prevents the gas from clinging to the surfaces in small bubbles and interfering with the transfer of oxygen to the blood.

The applicants believe first that it is unreasonable to expect a person in the field of marine seismic surveying to search for ideas in the field of open heart surgery. The recent *KSR* decision does not completely eliminate the need for the examiner to show motivation to combine. However, even if the seismic researcher happened to come across Cosentino, he would receive no inspiration relative to the technical problem addressed by the present invention. This is because Cosentino uses the wetting agent to remove residual air (so it can be flushed out by the priming fluid) from the oxygenator. He wants the air bubbles to be gone as quickly as possible, not to linger as long as possible which is the applicants' objective ("method for increasing the rise time of air bubbles . . ."). Moreover, Cosentino does not teach that the wetting agent is to influence bubbles "emitted from [the] diffuser," which in his case

would be the oxygen to be added to the heart patient's blood. (The analogy to the applicants' invention is even weaker because it appears that the Cosentino's filaments release oxygen not in bubbles but to be dissolved directly into the heart patient's blood; thus, Cosentino does not teach a bubble diffuser.) Instead his objective is to affect gas bubbles initially present in his oxygenator that he wants to flush out in the priming process.

Bernd does share the applicants' objective of keeping the bubbles in existence as long as possible. But Bernd believes that the primary threat to this is dissolving of the air into water, and not coalescence of small bubbles into larger ones which then rise more rapidly to the surface and "pop." (Col. 3, lines 21-35; col. 4, lines 43-44.) The applicants' approach (embodied in claims 52 and 61) is that rise time is the dominant factor in bubble curtain life, and that rise time is increased by making smaller bubbles using wetting agents and/or preventing them from thereafter coalescing to form larger bubbles using a coalescence retarding additive. Thus a person of ordinary skill in the seismic surveying field, addressing the applicants' technical problem, would find nothing in Bernd or Cosentino that would suggest the solutions embodied in claims 52 and 61.

Thus, even if the hypothetical person were to read these three references, he would not find any information in any of the three references applicable to "increasing the rise time of air bubbles . . . in water." Moreover, the two references that teach using chemical additives do not teach them as increasing bubble rise time in water. The applicants further note that none of the three references indicate any recognition or understanding of the role of bubble coalescence in increasing bubble rise time. Behrens observes (col. 4, lines 7-8) that a recommended aperture configuration prevents coalescence of adjacently formed bubbles, and that is the extent of any discussion of bubble coalescence in the three references. There is no discussion in any of the three references of bubble coalescence retardation additives, or even a suggestion that such additives exist. Moreover, Behrens's concern about coalescence is because while he prefers large bubbles, he wants some small bubbles to attenuate the higher frequencies. He does not want his initial bubble size distribution, determined by aperture (nozzle) design, to be skewed by coalescence. Therefore, he

teaches coalescence control by aperture spacing for that reason and not as a way to maximize bubble rise time.

The *KSR* court stated, "Following these principles may be more difficult in other cases than it is here because the claimed subject matter may involve more than the simple substitution of one known element for another or the mere application of a known technique to a piece of prior art ready for the improvement." The applicants believe this is certainly true of obviousness issues raised by the present application.

The *KSR* decision continues: "Often, it will be necessary for a court to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the market place; and the background knowledge possessed by a person having ordinary skill in the art, all in order to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue. To facilitate review, this analysis should be made explicit. See *In re Kahn*, 441 F. 3d 977, 988 (CA Fed. 2006) ("[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obvious-ness").

As regards independent claims 52 and 61, that explicit analysis with articulated reasoning with rational underpinning would have to be the following words in the office action:

> With regard to claims 52 and 61, Behrens discloses using air bubbles emitted from a diffuser in water for the purpose of suppressing noise in a marine seismic survey (abstract; Column 1, Line 60 to Column 2, Line 16; Columns 4-5). Behrens teaches that the bubbles should not commingle (coalesce) before reaching the surface. Behrens does not disclose that a chemical additive is used with the bubbles generated to block the acoustic waves. Bernd teaches that it is known in the art of blocking acoustic waves in a marine environment to use chemical additives having bubble coalescence retardation properties with a bubble diffuser in order to prevent breakdown and dispersal of a bubble, thereby keeping bubbles small enough that they rise slowly and stay in an area behind the ship for a long time (Column 2; Column 3, Line 18 to

Column 6, Line 48). It would have been obvious to modify Behrens to include chemical additives as taught by Bernd in order to prevent breakdown and dispersal of the bubble curtain, thereby keeping bubbles small enough that they rise slowly and stay in an area behind the ship for a long time. Bernd discloses mixing the chemical additives in with the water at the time that bubbles are emitted. This requires keeping the chemical and nozzles to emit the chemicals onboard the ship with the rest of the equipment. Cosentino teaches that it is known to use chemical additives having bubble coalescence retardation properties with bubble diffusers (abstract; Column 4, Line 47 to Column 5, Line 26; Column 7, Line 14 to Column 9, Line 30). Cosentino teaches that the surfactant (chemical additives) can be coated onto the diffuser before use and then be allowed to dry and set (Column 4, Line 47 to Column 5, Line 26; Column 7, Line 14 to Column 9, Line 30). Cosentino teaches applying the chemical additives to the diffuser by flushing the device with the chemical additive, then draining and allowing the chemical additive and diffuser to dry. It would have been obvious to modify Behrens and Bernd to include applying the chemical additive to the diffuser before use and allowing it to dry as taught by Cosentino in order to allow the surfactant to act on the bubbles emitted by the diffuser without having to supply the chemical additive directly into the liquid surrounding the diffuser. Although Cosentino teaches flushing the device with the chemical additive and not applying it with a brush or spraying it onto the diffuser's surface, using a brush or spraying the chemical would be obvious because it would allow for the diffuser to be coated with surfactant and allowed to dry before use. The chemicals added to the diffuser by brush, spray, or flushing would act in the same way once allowed to dry.

Now the applicants wish to express their respectful disagreement with specific parts of this analysis of the examiner. As stated above, while Behrens teaches against bubble commingling and coalescence, his reason is not related to bubble rise time or the fact that large bubbles rise faster. In fact he teaches that "relatively large bubbles are preferred" (col. 4 line 59) and refers to small bubbles as "undesirable" (col. 5, line 39) because "generation of excessive numbers of small bubbles in the water column

tends to limit maximum bubble size" (col. 5, lines 35-36). Behrens teaches that bubble coalescence is controlled by diffuser aperture spacing. There is no apparent reason for a reader of Behrens to look for literature on coalescence retarding chemicals. For these reasons, the applicants strenuously disagree with the examiner's reasoning: "It would have been obvious to modify Behrens to include chemical additives as taught by Bernd in order to prevent breakdown and dispersal of the bubble curtain, thereby keeping bubbles small enough that they rise slowly and stay in an area behind the ship for a long time."

Next, the applicants disagree with the examiner's conclusion that "Bernd teaches that it is known in the art of blocking acoustic waves in a marine environment to use chemical additives having bubble coalescence retardation properties with a bubble diffuser . . ." The applicants agree that Bernd teaches that it is desirable for his (sonar-jamming) bubble curtain to remain "for an appreciable length of time." Bernd teaches that two mechanisms work against this desire: The bubbles "dissolve into the water or rise to the surface and go off." (Col. 3, lines 22-23) He then teaches that "small gas bubbles . . . "rise very slowly" and so would remain in a wake for an extremely long time, were it not that they tend to dissolve." (Emphasis added) Thus it is that the chemical additives that Bernd teaches to be introduced into the water "in the vicinity of [the] bubbles" are all additives selected for their ability to retard the rate of dissolving of the air bubbles. (Col. 3, line 35 and col. 4, lines 43-44) Neither Bernd nor either of the other two references cited by the examiner even suggest that bubble coalescence is a problem that limits bubble curtain life; and certainly none of these references teaches, as far as the applicants can tell, that one should look for an additive that retards bubble coalescence.

The applicants read Cosentino to teach the use of surfactant additives for the purpose of preventing air from adhering to his blood oxygenator surfaces and thereby resisting the prime fluid intended to sweep all such gas away. The applicants read Cosentino in vain for any suggestion that bubble coalescence is a problem, or that the surfactant additives will address such a problem. He wants additives that are wetting agents (col. 8, line 2), but fails to make the connection that such an additive located near the diffuser orifices will tend to cause smaller bubbles to be emitted. In fact,

Cosentino is not designing his chemical additive with a mind to its effect on the oxygen emitted by his diffuser at all. Instead, it is the effect on residual gas in the oxygenation chamber that concerns him.

The applicants are well aware that the *KSR* opinion instructs that prior art combined in a § 103 rejection need not all address the same technical problem as do the claims in the patent under examination. (In fact, none of the three references identifies or addresses the technical problem of claims 52 and 61.) However it is respectfully submitted that foregoing arguments show that the above-quoted examiner analysis does not constitute a rational underpinning for a reason to combine the three references to solve the applicants' technical problem. The applicants further submit that the particular solutions embodied in the applicants' claims are not made obvious by reading the three references. When the three references are examined in the light of whether they might likely be combined to teach the applicants' solution to the applicants' technical problem, there are too many disconnects, too many obstacles with respect to which the cited art teaches more away than toward making the combination or arriving at the applicants' invention. Therefore the applicants believe that the examiner has failed to make a prima facie case of obviousness.

Independent claims 70, 79 and 83

Independent claim 70 is substantially identical to claims 52 and 61 except the additive is applied to the diffuser by immersing the diffuser, i.e. dunking. Since the applicants' arguments above for claims 52 and 61 do not rely on the method of application of the additive, those arguments are believed to be fully applicable and persuasive for claim 70. Similarly, independent claims 79 and 83 contain the same limitations as claims 52 and 61, except for the method by which the additive is applied to the diffuser (dunking). Therefore, the above arguments are also believed to be fully applicable and persuasive for claims 79 and 83.

Claim 79 contains the further limitation that the chemical additive must be substantially water insoluble. In addition to all of the above arguments made for claims 52 and 61, the applicants must respectfully disagree with the examiner's conclusion (near top of page 9) that Bernd teaches using substantially water-insoluble chemical additives. To the contrary, Bernd lists as the No. 1 characteristic that his

chemical additive "must have" as follows: "(1) Solubility in water, at least in trace quantities." The applicants must regard this as a teaching away from the method of claim 79.

Claim 83 contains the additional limitation that the dunking is to be into a solution wherein the wt. % of the chemical additive is at least 25%. The examiner relies on Bernd col. 4 lines 46-48 as showing this limitation. Those lines read, "The initial concentration of additive (mass of material per unit volume of water) also affects performance and so can be used as a means of control." Bernd's dunking vessel is the entire ocean, and he "introduces" some additive in the vicinity of the bubble wake of the ship that seeks to avoid sonar detection. It is inconceivable that Bernd could be envisioning an additive concentration anywhere near as large as 25%. The larger point is that applications like Bernd where the solution of the additive *is* the means and end-all with no intent to coat the diffuser cannot teach anything about concentrations for methods based on coating the diffuser. The applicants respectfully believe that the 25% concentration limitation is not disclosed or reasonably suggested in Bernd, just as it was not suggested in Zahradnik.

All pending dependent claims are believed to be patentable as claims depending from patentable independent claims.

§ 112 claim rejection

The applicants have reworded claim 74 to remove any possible confusion about antecedent basis. The amended claim, shown in the listing of claims, should overcome the § 112 rejection.